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Page 1 of 2

# PATENT ABSTRACTS OF JAPAN

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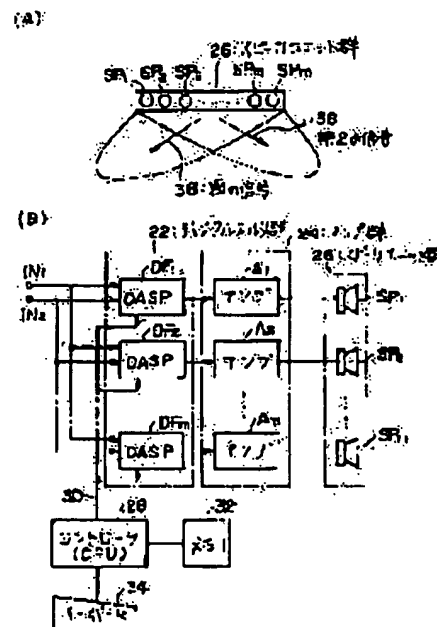
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## (54) SPEAKER EQUIPMENT

### (57)Abstract:

**PURPOSE:** To emit a sound from a speaker with a desired directivity by employing the speaker directivity control technology.

**CONSTITUTION:** The speaker equipment is provided with plural speaker unit groups 26 arranged at least in a line and digital filter groups 22 respectively connecting to the plural speaker unit groups 26. Plural audio signals are inputted in common to each digital filter and a characteristic of each digital filter is respectively revised with respect to the plural audio signals to allow a correspondent speaker unit to have a desired directivity for the plural audio signals. When 1st and 2nd signals are inputted to digital filters DF1-DFm, the digital filters DF1-DFm apply parallel processing to the two inputted audio signals to allow the speaker unit group 26 to have a desired beam directivity. Thus, a signal is sounded from the speaker with the desired directivity.



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3. In the drawings, any words are not translated.

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**DETAILED DESCRIPTION**

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[Detailed Description of the Invention]

[0001]

[Industrial Application] this invention relates to the directive loudspeaker equipment which has the directivity from which sound pressure strong against a specific place is obtained.

[0002]

[Description of the Prior Art] Usually, when performing explanation which is different in the booth which adjoins at the exhibition hall etc., or when performing an announcement which is different at the \*\*\*\*\* home of a station, in order to make voice easy to catch, it is effective to use the directive loudspeaker from which sound pressure strong only against a specific place is obtained.

[0003] Conventionally, as a means to realize the \*\*\*\*\* of sound, the method of arranging two or more loudspeaker units at equal intervals on a straight line is learned. Hereafter, it explains, referring to drawing 9 and drawing 10 about the composition.

[0004] Drawing 9 is directive loudspeaker equipment which arranged the loudspeaker unit 1 with an aperture of 9.4cm at intervals of [ eight ] 11cm on the x axis of xy flat surface. Thus, when a loudspeaker unit 1 is arranged, sharp directivity is obtained in the direction of a x axis, and it becomes indirectivity in y shaft orientations closely. Drawing 10 shows the directivity of the direction of a x axis in 4kHz at the time of inputting 1.00, 0.81, 0.52, and the sinusoidal signal of 0.26V in phase into this directive loudspeaker equipment towards the outside loudspeaker unit 1, respectively from two central loudspeaker units 1. Moreover, the distance of the directive loudspeaker equipment at this time and a station (listening point) is 6m.

[0005]

[Problem(s) to be Solved by the Invention] However, with the above conventional directive loudspeaker equipments, there is a problem that the side lobe of strong level occurs, in the frequency of 3.2kHz or more on which the wavelength of an acoustic wave becomes short rather than the interval (11cm) of a loudspeaker unit 1. For example, as shown in drawing 10, in 4kHz, the side lobe strong against the angle of 50 right and left has occurred from the transverse plane.

[0006] When the wavelength of an acoustic wave is shorter than the interval of a loudspeaker unit 1, such a strong side lobe occurs, because the angle to which the phase of the acoustic wave emitted from each loudspeaker unit 1 also angles other than a transverse plane is equal exists. Therefore, however it may control the voltage value of the signal inputted into a loudspeaker unit 1, this side lobe cannot be lost. Therefore, also in high frequency, although the interval of a loudspeaker unit 1 must be made small in order to obtain directivity without a side lobe, for that, a loudspeaker unit with very small aperture is needed, and the technical problem that realization is difficult occurs.

[0007] this invention aims at offering the directive loudspeaker equipment which a strong side lobe does not generate also in the frequency band of wavelength shorter than the interval of a loudspeaker unit in consideration of such a technical problem of conventional directive loudspeaker equipment.

[0008]

[Means for Solving the Problem] Two or more loudspeakers (A) are the positions of the next door of the loudspeaker train arranged by the single tier at the predetermined intervals, and its loudspeaker train, and this invention is directive loudspeaker equipment equipped with one piece or two or more loudspeakers (B) which have been arranged so that the positions of these loudspeakers may differ on the basis of the direction of the loudspeaker train.

[0009]

[Function] One piece or two or more loudspeakers (B) are the positions of the next door of a loudspeaker train where two or more loudspeakers (A) were arranged by the single tier at the predetermined intervals, and since this invention is arranged so that it may differ from the position of these loudspeakers on the basis of the direction of the loudspeaker train, it becomes being the same seemingly as the interval of each loudspeaker became small.

[0010]

[Example] Below, this invention is explained based on the drawing in which the example is shown.

[0011] Drawing 1 is the block diagram of the directive loudspeaker equipment of the 1st example concerning this invention. That is, it is directive loudspeaker equipment which consists of a loudspeaker unit 1 of 15 9.4cm aperture, and is constituted by the loudspeaker array 3 which consists of seven loudspeaker units 1 arranged by 11cm interval the same on the straight line which is parallel to the loudspeaker array 2 which consists of eight loudspeaker units 1 arranged by 11cm interval on the straight line, and its loudspeaker array 2. Drawing 2 indicates similarly the directivity in 4kHz at the time of inputting the signal of an inphase and this level into each loudspeaker unit 1 of this directive loudspeaker equipment to be drawing 10. Compared with the case of the directivity of drawing 10, the strong side lobe in the direction of 50 degrees has disappeared the directivity of drawing 2. As a result, the frequency band as directive loudspeaker equipment will spread in a high region side.

[0012] The distance of a loudspeaker system and a listening point can consider the above directivity as follows, when sufficiently large compared with the length of a loudspeaker array. The directivity in the direction of a x axis in the case of having arranged two or more loudspeaker units two-dimensional on xy flat surface and the directivity in the direction of a x axis at the time of setting the y-coordinate of the center of each loudspeaker unit with 0, and arranging on a x axis in the loudspeaker system, (namely, when these loudspeaker units having been temporarily arranged in single dimension) become almost the same. Therefore, if it arranges the loudspeaker array of two or more trains so that it may arrange in parallel with a x axis and the x-coordinates of the center of each loudspeaker unit may not overlap in making directivity in the direction of a x axis into a problem, the interval of a loudspeaker unit can be seemingly made small. Thereby, directivity without a side lobe can be obtained now also in high frequency.

[0013] Next, the directive loudspeaker equipment of the 2nd example of this invention is explained, referring to drawing 3 and drawing 4.

[0014] In drawing 3, the loudspeaker section consists of same loudspeaker unit 1 as what was used in the 1st example, and same loudspeaker arrays 2 and 3. In each loudspeaker unit 1 of the loudspeaker array 2 For every loudspeaker unit of the couple arranged about a center section at the symmetric position, as a signal conditioning means The level-setting machines 42, 44, 46, and 48 which set up the level of the signal inputted are connected. to each loudspeaker unit 1 of the loudspeaker array 3 The level-setting machine 41 is connected to the loudspeaker unit 1 of a center section, and the level-setting machines 43, 45, and 47 are connected by other loudspeaker units 1 like the loudspeaker array 2 for every loudspeaker unit of the couple arranged about a center section at the symmetric position. The amplifier 5 which amplifies a signal is connected to these level-setting machines 41-48, and the source 6 of a signal is connected to the amplifier 5.

[0015] Here, the input level to each loudspeaker unit 1 is set up so that it may become low with 1.00, 0.97, 0.89, 0.78, 0.63, 0.47, 0.33, and 0.28V as the position of a loudspeaker unit 1 approaches an edge from a center section.

[0016] As mentioned above, although it is on a straight line and a loudspeaker unit 1 is arranged at equal intervals like the conventional example, and it is known that the level of a side lobe will be reduced when a center section is high and the input level to each loudspeaker unit 1 is made for a periphery to become low, when arrangement of a loudspeaker unit 1 like this example is taken, it completely acts similarly. Therefore, as shown in drawing 4, a strong side lobe as showed the directivity in 4kHz to drawing 10 is not generated, but the level of a side lobe is further stopped by -30dB or less at the whole as well as a strong side lobe [ in / the direction of 50 degrees / compared with the case of drawing 2 / for this ] disappearing.

[0017] Next, the directive loudspeaker equipment of the 3rd example of this invention is explained,

referring to drawing 5 .

[0018] In drawing 5 , 1 is the same loudspeaker unit as having used in the 1st example, and 2 and 3 are the same loudspeaker arrays as what was used in the 1st example. The band pass filters 71-78 which have a different passband as a signal conditioning means are connected for every loudspeaker unit of the couple which is in a symmetric position about a center section, and that by which the passband is connected to the outside loudspeaker unit 1 from a center section is set as the low frequency band. Amplifier 5 is connected to these band pass filters 71-78 like the 2nd example, and the source 6 of a signal is connected to the amplifier 5. Although \*\*\*\*\* is obtained also by using independently the loudspeaker unit 1 of the couple which is in a symmetric position to a center section, the band where \*\*\*\*\* is obtained in this case is limited to the narrow frequency range of about 1/3 octaves centering on frequency with the wavelength near the interval of the loudspeaker unit 1 of this couple, and, as for frequency, an interval becomes low like latus. Therefore, a latus frequency band is obtained by connecting the band pass filter according to the frequency range. Like the conventional example, a loudspeaker unit 1 is on a straight line, and this is completely the same, as well as the case where it has been arranged at equal intervals when arrangement of a loudspeaker unit 1 like this example is taken.

[0019] Moreover, the example which changed a part of band pass filter of this example as follows is explained. As shown in drawing 6 , high-pass filter 71a which has a cut off frequency equal to the center frequency of the band pass filter 71 in the loudspeaker unit 1 of the center section of the loudspeaker array 3 instead of the band pass filter 71 used by this example is connected, and low pass filter 78a which has a cut off frequency equal to the center frequency of a band pass filter 78 instead of the band pass filter 78 used by this example is connected to the loudspeaker unit 1 of the both ends of the loudspeaker array 2. Also in this case, the same effect as this example is acquired, and sharp directivity is obtained in a large frequency band.

[0020] Next, the 4th example of this invention is explained, referring to drawing 7 .

[0021] In drawing 7 , 1 is the same loudspeaker unit as having used in the 1st example, and 2 and 3 are the same loudspeaker arrays as what was used in the 1st example. The low pass filters 81-88 which have a different cut off frequency as a signal conditioning means are connected for every loudspeaker unit of the couple which is in a symmetric position about a center section, and the cut off frequency is set as as low frequency as what is connected to the outside loudspeaker unit 1 from a center section. Amplifier 5 is connected to these low pass filters 81-88 like the 2nd example, and the source 6 of a signal is connected to the amplifier 5. Since the band where \*\*\*\*\* is obtained by the loudspeaker unit 1 of the couple which is in a symmetric position about a center section was narrow, although the steep filter was needed in the 3rd example, in this example, the damping property of a filter does not necessarily need to be steep, the efficiency of loudspeaker equipment improves from the case of the 3rd example, and sharp directivity is obtained in a large frequency band. Like the conventional example, a loudspeaker unit 1 is on a straight line, and as well as the case where it has been arranged at equal intervals when arrangement of a loudspeaker unit 1 like this example is taken, the same is said of this.

[0022] Moreover, even when a low pass filter is not connected to the loudspeaker unit 1 of the center section of the loudspeaker array 3 but it connects with the direct amplifier 5 as a part of this example is changed, for example, it is shown in drawing 8 since it has sufficient directivity also with a loudspeaker-unit simple substance in a high region, the same effect as this example is acquired.

[0023] In addition, about the number of not only this but a loudspeaker (A), although the number of a loudspeaker unit was made into eight pieces as a loudspeaker (A) and the number of a loudspeaker unit was made into seven pieces as a loudspeaker (B) in the above-mentioned example, if it is one or more pieces, it is [ number / of two or more pieces and a loudspeaker (B) ] applicable.

[0024] Moreover, if it arranges so that the position of each loudspeaker may be differed on the basis of the direction not only of this but a loudspeaker train, it is easy to be natural, although two trains constituted the loudspeaker array which is a loudspeaker train from the above-mentioned example also, for example as three or more trains.

[0025] Moreover, in the above-mentioned example, although two trains have arranged the interval of each loudspeaker unit at the same interval, you may differ for every train.

[0026]

[Effect of the Invention] this invention has the advantage in which a strong side lobe does not occur, also in the frequency band of wavelength shorter than the interval of a loudspeaker unit so that clearly from the place described above.

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[Translation done.]